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Germany was the first major country to commit itself to an electricity system transition based on decentralized renewable sources and energy efficiency. This experiment has attracted interest worldwide, but its influence on national energy debates is largely unknown. We study how the German transition appeared in the news media of three countries following alternative nuclear pathways - the United Kingdom, Finland and Hungary - between 2011 and 2015. We show that most discussions are techno-economic, supply-oriented and focused on nuclear, wind and solar energy. Key issues such as energy democracy, regional development, participation, demand-side measures, and bioenergy are neglected. We find that topics are detached from their original contexts and selectively contextualized elsewhere, resulting in very different pictures of the same transition in specific countries and news sources. The 'Energiewende' has become part of the international energy policy landscape, but its representation depends on local visions of a good society.

Significant increases in energy efficiency and electricity production from renewable sources are widely considered essential for energy transitions. The first countries that pursue this path inevitably set an example and reveal challenges and opportunities regarding security, affordability, sustainability and democratic participation. In Germany, after decades of discussions and disagreement on how to change energy systems, the 2011 Fukushima disaster brought unity to the parliament and led to the decision to not postpone the nuclear phase-out, but instead to further accelerate renewable energy development, and to reiterate commitment to energy efficiency[1]. The German transition, called the 'Energiewende' has a long history rooted in resistance against nuclear power, community-level development of renewable energy, and broad public support (see Supplementary Note 1). It has been extensively examined and discussed in public and academic debates all over the world[2–4].

How the Energiewende is interpreted and contextualized at the national level outside Germany has received little attention. This is surprising because the global significance of the Energiewende is more due to its international than domestic effects. Germany, responsible for 2.2% of global carbon emissions, has been watched by many of the countries that make up the remaining 97.8%. The Energiewende is mostly discussed

as a long-term process of change in the national energy regime[5–7]. However, viewed from other countries, it is rather a process of change in the international landscape of energy policy.

We use the 'landscape' concept from the multi-level perspective on sustainability transitions to denote the broader economic, social and political circumstances of domestic energy systems[8,9]. In the sustainability transitions literature, the landscape level is usually presented as a set of heterogeneous factors that is exogenous and beyond the control of domestic actors, exerting influence through slow changes, such as technological progress or climate change, or sudden shocks, such as nuclear accidents[9]. However, according to a discursive approach, what matters is how these landscape-level changes are interpreted and socially constructed within specific times and places[10]. The assessment of the gravity and implications of landscape pressures will differ based on how these pressures are represented. Thus, besides carrying direct material and social consequences through changes to renewable energy technologies and prices, the German experience can influence domestic transformations as it is interpreted in local contexts. These interpretations can help efforts to stabilize or destabilize existing national energy regimes[11]. How such long-term, first-of-a-kind energy policy changes are conceptualized elsewhere can shed light on societal debates about the role of energy in visions of a good society.

We use an interpretative comparative analysis to examine how the electricity system transition part of the Energiewende was discussed, interpreted and connected to local issues in the news media between 2011 and 2015 in leading daily news sources in three European countries: in *The Times* and *The Guardian* in the United Kingdom (UK), in *Helsingin Sanomat* in Finland, and in *Index* and *Origo* in Hungary. The UK, Finland and Hungary are the only European countries that have approved new nuclear plants after Germany's phase-out decision of 2011 (Supplementary Table 1). None of the countries are neighbours of Germany with direct power line connections; however, all of them experience its strong regional influence through EU level energy policy making and Germany is their most important trade partner[12]. Despite the similarity of opting for nuclear new-build, the countries' electricity production profiles differ (for a comparison which also includes Germany, see Supplementary Table 2). The UK has been a leader in developing offshore wind energy, whereas Finland has a long history of bioenergy development as a by-product of the pulp and paper industry[13]. Hungary has almost the lowest share of renewable electricity production in the EU, on par only with some of the smallest member states[14].

All three countries have committed to the joint effort of the EU to reduce carbon dioxide emissions by at least 80% from 1990 levels by 2050[15]. In the UK, the pro-market energy policy paradigm of the early 2000s was challenged by a coalition of non-governmental organisations (NGOs), academics and policy groups who questioned its adequacy to address climate change and security of supply[16] and called for long-term governmental action[17]. Subsequent top-down policies triggered some reorientation towards renewables without upsetting the dominance of incumbent actors[5]. Media coverage of energy policy and climate change has been strongly aligned with the ideological orientation of leading daily newspapers[17,18]. Finland may be characterized

as an inclusive corporatist state with a tradition of consensus policies, negotiated largely amongst existing interest groups[19]. Energy policy has been driven by the aims of the energy-intensive industries, which supported the development of nuclear energy[13]. News coverage in *Helsingin Sanomat* has also favoured nuclear energy[17]. In Hungary, liberalization of the electricity sector in the 2000s made wholesale markets free, while decision makers maintained their disposition towards centralized decision making. For instance, successive governments proceeded with the new nuclear project without open consultations. Discussions in the news media have been dominated by reactions to political decisions, focusing on nuclear and paying little attention to renewable energy[20].

We perform a comparative analysis, which requires paying attention to how objects are detached from their original context and circulated elsewhere and what happens to their representation in this process[21]. Our analysis takes the Energiewende as an object that is transformed as it travels to different contexts[22,23]. This means examining how the news media refers to and uses the concept of the Energiewende; how it is contrasted with local policies; and where and by whom it is contested or supported[24]. The three countries we examine have different civic epistemologies – i.e. culturally, historically and politically grounded ways for publics to evaluate the credibility of claims, for instance in the field of energy policy[24]. By adopting a discursive approach, we stress the significance of language, ideas and discourse for building the legitimacy and credibility of specific innovations and policy approaches[25–27]. Our analysis focuses on areas of similarities and differences among the three countries, popular depictions and marginal views of the transition and source-specific characteristics and omissions in news coverage. We coded the empirical material inductively and iteratively. Although we present quantitative figures to characterize the material, our analysis is based on a qualitative and interpretive assessment. While we find different normative assessments of the Energiewende across national contexts, there is an overarching tendency to contextualize it through techno-economic topics and supply-side technologies, paying most attention to nuclear, wind and solar energy.

Cross-national similarities in news coverage

The German transition is most often used as a point of reference, highlighting one or a few of its specific aspects, often in articles discussing domestic energy issues. A smaller set of articles devote longer sections or the full article to the Energiewende. While certain articles explicitly call for following or avoiding the German path, most of them do not. Nevertheless, the majority of articles posit a supporting (positive) or opposing (negative) normative stance towards the Energiewende. Articles that contain discussions of both positive and negative outcomes constitute a relative minority (Fig. 1). A breakdown by article types is given in Table 1.

Table 1. The number of articles in the studied sources by article type.

Source	Editorial or column	News article	Opinion letter	Total
The Guardian **(UK)**	**44**	**217**	**39**	**300**
The Times **(UK)**	**21**	**68**	**13**	**102**
Helsingin Sanomat **(Finland)**	**12**	**42**	**37**	**91**
Index + Origo **(Hungary)**	**0**	**55**	**1**	**56**

Note. An editorial or column is a text written by the newspaper staff that offers a distinct position. A news article covers a topic without an explicitly normative stance. This category includes news analysis and interviews. An opinion letter reflects the opinion of the author, who is not part of the newspaper's staff. We realize that the suggested categories have overlaps and their distinction is not always clear, but present this to show the diversity of different types of articles where the Energiewende is discussed. Differences between article types in the studied sources are an important reason to be cautious about drawing conclusions from the quantitative indicators.

Several trends over time can be observed. Initial reactions were more descriptive than later discussions. News sources published several pieces on the post-Fukushima decisions by Germany and German companies without commenting on these, giving most emphasis to the nuclear phase-out (2011) and its international consequences, particularly the involvement of German companies in nuclear projects abroad (2011-2012). Initial reactions rarely reflected on the longer term, disruptive implications of the Energiewende, especially concerning utility companies. When such implications materialized, several actors developed more ideologically charged assessments of the transition and its desirability, making the issue more politically polarized. Around 2013, discussions of the high costs of German energy policy became more frequent. In the run-up to the 2015 Paris climate conference, the implications for greenhouse gas emissions received increased coverage.

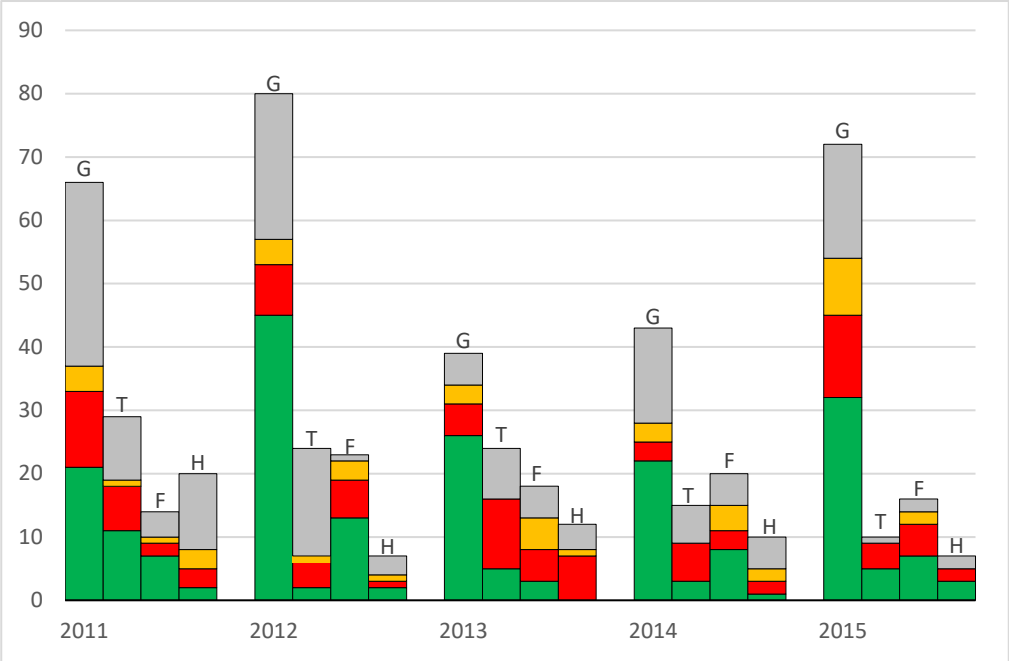

Fig. 1 News media coverage of the Energiewende over time. The number of positive (green), negative (red), ambivalent (orange) and descriptive (grey) articles in *The Guardian* (G), *The Times* (T), *Helsingin Sanomat* (Finland; F) and *Index and Origo* (Hungary; H) from 2011–2015.

While there were large differences between the sources in terms of the topics discussed (for a definition of topic codes see Table2, for the number of articles with each code see Table 3), we identified three major similarities that did not substantially change over the studied period. First, techno-economic aspects are dominant. Almost all articles mention either some technological or economic issues, such as the changing electricity mix or the costs of supporting renewables. In contrast, environmental and climate concerns occur in less than 20% of all articles, and social aspects such as local participation and regional added value get similarly limited attention. This techno-economic focus differs from historical accounts of the Energiewende[2] and is at odds with the complex motivations of elite policy actors[28] and members of community energy projects[29], two pivotal groups behind the German transition.

Second, among the core technological characteristics of the Energiewende the demand side gets much less coverage than the supply side. Energy efficiency is rarely mentioned (in 1–11% of all articles) compared to the nuclear exit (31–49%) and the rise of renewable energy (31–43%). This differs from German parliamentary debates, where measures to increase energy efficiency are called for by all sides of the political spectrum[3]. However, it is in line with a more general tendency of public institutions, policies and financial resources to favour supply-side options at the expense of the demand side[30].

Third, concerning emerging supply-side technologies, virtually all discussions concentrate on wind and solar energy, while the increasing use of bioenergy is hardly mentioned. This is surprising because Germany is a forerunner in the use of biogas[31], bioenergy provides more power in Germany than solar and its growth, which started in the 2000s, was not negligible in the studied period (Supplementary Table 2). Unlike changes of

support for solar energy, the 2014 policy change regarding different types of biomass and other biogenic resources was hardly mentioned in the media. The lack of attention to bioenergy conceals the potential relevance of German experiences for other countries.

Table 2*. Code definitions. The inductively developed codes used for the analysis. Additional codes were developed but found to be less prevalent or less important for the analysis (certain codes were found important due to their low prevalence).*

Topic	**Definition**	**Krippendorff's alpha**
Nuclear phase-out	A reference to Germany's nuclear phase-out policy	0.88
High/increasing use of renewable energy	A reference to Germany increasing, or planning to increase, its use and output of renewable energy	0.83
Energy efficiency	A reference to Germany's policies regarding measures for improving energy efficiency	1
Economic competition	German energy policy is discussed with reference to global economic competition	0.72
Low cost of transition	The Energiewende is discussed as cheap	0.78
High cost of transition	The Energiewende is discussed as expensive	no data
Economic opportunities	The economic opportunities of the Energiewende are highlighted	1
Positive stance on renewable energy support	Government support for renewable energy, including policy measures and economic incentives, are discussed in a positive manner	0.78
Negative stance on renewable energy support	Government support for renewable energy, including policy measures and economic incentives, are discussed in a negative manner	no data
Descriptive account of renewable energy support	Government support for renewable energy, including policy measures and economic incentives, are discussed descriptively	no data
Industrial exemption from renewable energy surcharge	Reference to Germany's policy of exempting large industries from paying the renewable energy surcharge in electricity prices	1

Wholesale power price reduction	Reference to the reduction of wholesale prices of electricity due to the very low operating costs of renewable energy technologies	1
Woes of utility companies	Reference to the problems that energy utility companies in Germany are experiencing or could experience in the future	1
Job gains due to transition	Reference to potential and actual creation of new jobs as due to the Energiewende in Germany	1
Job losses due to transition	Reference to potential and actual loss of jobs as due to the Energiewende in Germany	no data
Ownership of renewable energy	The ownership of renewable energy production technologies by individual citizens or citizen groups	1
Popularity of Energiewende	Reference to the popular support in Germany for the Energiewende	no data
Grassroots groups in politics of transition	When the role of grassroots groups, NGOs or citizens is highlighted in contributing to the political process of the Energiewende	1
Negative effects of high/increasing use of fossil fuels	Negative depiction of high or increasing use of fossil fuels in Germany	0.89
Negative effects on climate change	Germany's energy policy discussed as causing negative climate change (mitigation) impacts	0.80
Positive effects on climate change	Germany's energy policy discussed as causing positive climate change (mitigation) impacts	no data
Techno-system problem (e.g. grid)	Problems in Germany's electricity production system, for example its electricity grid, are discussed	no data
Intermittency problem of renewable energy	The intermittency of renewable energy is depicted as problematic	no data

Reference to outliers	Selection of individual topics or figures from German energy policy without providing broader context for interpretation	1
Renewable energy vs. nuclear (either-or)	Juxtaposition of renewable energy with nuclear energy as an either-or choice in energy policy	no data
Energiewende shows transitions are possible	The Energiewende is discussed as an example showing that energy transitions are possible	0
Germany as reference point	When Germany is used as a comparison or reference point to one of the three countries, without a competitive or normative aspect. This category includes all numerical comparisons between Germany and the UK/Finland/Hungary	0.86
Follow Germany	An expressed preference to follow the Energiewende or parts of it	0.84
Do not follow Germany	An expressed preference not to follow the Energiewende or parts of it	no data

Table 3. Number of articles (percentages in brackets) for each topic code in the studied news sources.

Code Category	Topic	*The Guardian* (UK)	*The Times* (UK)	*Helsingin Sanomat* (Finland)	*Index* and *Origo* (Hungary)
Main Technological aspects of the Energiewende	Nuclear phase-out	94 (31%)	50 (49%)	42 (46%)	27 (48%)
	High/increasing use of renewable energy	92 (31%)	32 (31%)	37 (41%)	24 (43%)
	Energy efficiency	32 (11%)	1 (1%)	7 (8%)	4 (7%)
Economic aspects	Economic competition	41 (14%)	15 (15%)	11 (12%)	1 (2%)
	Low cost of transition	17 (6%)	1 (1%)	2 (2%)	3 (5%)
	High cost of transition	22 (7%)	12 (12%)	18 (20%)	13 (23%)
	Economic opportunities	22 (7%)	0 (0%)	12 (13%)	2 (4%)
	Positive stance on renewable energy support	32 (11%)	5 (5%)	7 (8%)	3 (5%)
	Negative stance on renewable energy support	5 (2%)	4 (4%)	16 (18%)	5 (9%)
	Descriptive account of renewable energy support	14 (5%)	8 (8%)	7 (8%)	1 (2%)
	Industrial exemption from renewable energy surcharge	3 (1%)	7 (7%)	5 (5%)	0 (0%)
	Wholesale power price reduction	12 (4%)	9 (9%)	3 (3%)	3 (5%)
	Woes of utility companies	14 (5%)	11 (11%)	13 (14%)	4 (7%)
Socioeconomic aspects	Job gains due to transition	21 (7%)	3 (3%)	12 (13%)	2 (4%)
	Job losses due to transition	5 (2%)	3 (3%)	3 (3%)	0 (0%)
Social aspects	Ownership of renewable energy	43 (14%)	3 (3%)	8 (9%)	1 (2%)
	Popularity of Energiewende	23 (8%)	1 (1%)	6 (7%)	4 (7%)
	Grassroots groups in politics of transition	7 (2%)	1 (1%)	2 (2%)	1 (2%)
Environmental aspects	Negative effects of high/increasing use of fossil fuels	35 (12%)	10 (10%)	21 (23%)	5 (9%)
	Negative effects on climate change	31 (10%)	8 (8%)	14 (15%)	5 (9%)
	Positive effects on climate change	10 (3%)	0 (0%)	6 (7%)	0 (0%)
Other technological aspects	Techno-system problem (e.g. grid)	7 (2%)	1 (1%)	12 (13%)	2 (4%)
	Intermittency problem of renewable energy	3 (1%)	2 (2%)	10 (11%)	6 (11%)
	Renewable energy vs. nuclear (either-or)	17 (6%)	2 (2%)	2 (2%)	6 (11%)
Lessons from Germany	Reference to outliers	6 (2%)	0 (0%)	1 (1%)	5 (9%)
	Energiewende shows transitions are possible	13 (4%)	1 (1%)	5 (5%)	3 (5%)
	Germany as reference point	81 (27%)	13 (13%)	32 (35%)	21 (38%)
	Follow Germany	21 (7%)	6 (6%)	7 (8%)	2 (4%)
	Do not follow Germany	4 (1%)	5 (5%)	5 (5%)	2 (4%)

Two accounts of transition address competitiveness in the UK

The two British sources show how selective attention and contextualization work. There are substantial differences in the extent of the coverage, the tone of the coverage, the affiliation of the people quoted, and the topics discussed. There are 300 vs. 102 articles mentioning the Energiewende in *The Guardian* vs. *The Times*, out of which 17-25 vs. 1-7 articles can be considered in-depth discussions (with different definitions of in-depth based on article length, see Methods). The tone is 49% positive, 14% negative, 8% ambivalent and 30% descriptive in *The Guardian* and 25% positive, 31% negative, 2% ambivalent and 41% descriptive in *The Times*. Note that 7% of the articles in *The Times* are classified as positive only because they present the exemption of large industries from the renewable surcharge in Germany as a good example, and another 10% were written within 6 months of the Fukushima disaster. In both newspapers, the opinions of politicians and experts appear frequently, but *The Guardian* also regularly quotes representatives of NGOs (26 times) while *The Times* quotes incumbent business leaders (9 times). Greenpeace appears 10 times in *The Guardian*, Shell and BP 5 times in *The Times*. Representatives of business groups interested in a transition, such as the wind and solar industries, appear as often as established energy industry actors in *The Guardian*, while the former have no voice in *The Times*.

The topics discussed (Table 3) reveal the positive and negative images of the UK and its energy policy examined against the German example, as put forward in outlets with different political orientations. *The Guardian* frequently writes about the economic opportunities of energy transitions, debates the costs and emphasizes the benefits of supporting renewables. More than the other sources, it concentrates on decentralization and the ownership of wind and solar installations. These are presented as means for social and political change, rather than mere questions of technology adoption. In the words of a sustainability expert writing in the 'Public Leaders Network' section of the newspaper, 'adopting a people-centered approach and empowering citizens, farmers and small businesses to invest in renewable energy projects, is a tool for socio-economic development and wealth distribution'[32]). This challenges current power structures in energy production, especially threatening the UK's six big utility companies, as articulated by a volunteer of a community energy NGO interviewed in a news article: 'If you look at Germany, the community renewables sector has grown very big, and it is making a dent in the big electricity companies' profits. They [the big six] don't want that to happen here'[33]. In *The Guardian*, the problem with the Energiewende is its reliance on coal and the negative climate impacts, as the future must be low carbon. Nevertheless, the German transition serves as an example from which there is much to learn and follow for long-term success.

The Times concentrates on the short-term consequences of the Energiewende for citizens and industries and more on domestic issues. The German nuclear exit is important in large part because it triggered the sale of Horizon Nuclear Power, the contractor of a British nuclear project (Supplementary Table 1). The fact that utility companies are losing value as they are 'hit by the glut of renewable energy generators in Germany that have pushed wholesale prices to rock-bottom levels' is notable partly because 'significant job losses are

expected for the UK'[34]. German renewable energy support is contrasted with UK support in two distinct ways. First, a negative example is spending too much of ratepayers' money on renewables, raising residential electricity prices well above those in the UK. Second, German support is more business friendly than support in the UK, which is co-financed by large industries. As the energy editor writes in the Business section, 'British steelmakers and other big manufacturers are being forced to pay twice as much for their electricity as competitors in Germany'[35]. Frequently mentioning Germany's high reliance on fossil fuels seems to follow from concentrating on the negative aspects of the Energiewende, rather than concerns over coal use, which sometimes appears in a positive light in *The Times*. Disregarding social issues (see Table 3) is in line with the opinion of a former BP executive: 'Energy policy should only be about providing secure energy for industry and consumers'[36]. Following Germany is thus a mistake.

One priority that bridges the ideological distance between the two sources is commitment to international competitiveness. Not falling behind other countries in global economic competition receives broad support from the director of Greenpeace in *The Guardian* to the CEO of a traditional energy investment company in *The Times*. Whether competitiveness comes from investment in cutting-edge clean technology or low prices for traditional manufacturing is debated, but whether it is crucial to maintain and foster industry and jobs in the UK is not. This shows a shared goal in the two sources, with diverging proposals on how to achieve it.

Debating industrial goals and carbon neutrality in Finland

With a total of 91 articles that include 10-23 in-depth discussions, *Helsingin Sanomat* contains substantial coverage of German energy policy and active discussion over how the Energiewende should be interpreted in the context of Finland. The views presented are rather polarized, with 42% positive, 23% negative, 17% ambivalent and 19% descriptive articles. The discussions focus on the economic and climate impacts of the German transition.

A parallel is drawn between Germany and Finland as industrial countries, while recognizing the differences in energy and electricity production (Supplementary Table 2). There are two distinct lines of argument for how these differences should be interpreted. One side presents Germany as a global leader committed to climate change mitigation through the increase of new, decentralized renewable energy technologies, with Finland pursuing old technologies no longer viable on global markets. The other side portrays Germany as following an expensive and carbon-intensive pathway, whereas Finland has long ago committed to carbon neutrality through the pursuit of nuclear energy and biomass. At first sight, it appears striking that German developments are not connected to the frequently discussed topic of bioenergy and bio-economy[37]. This is likely due to the two countries' bioenergy sources, technologies and user groups being very different: in Finland the focus is on the forest industry, while in Germany on agriculture and biogas development.

The negative portrayal of Germany often interlinks questions of increasing renewable energy production with high costs and a negative stance towards policy support for renewables; intermittency and technological problems; or climate concerns (Table 3). For instance, a foreign correspondent for Germany writes, 'the

greatest explanation for the use of coal is that renewable energy cannot be produced evenly. The wind blows differently during the different seasons, and the sun does not shine continuously. An industrial country's electricity grid requires steady electricity'[38]. Proponents of nuclear energy, such as the energy industry lobby and various nuclear activists, often contrast the carbon neutrality of nuclear with Germany's electricity mix, accusing the country of attaining a false image of global leadership on green policies while continuing investments in fossil fuels. Another comparison made by the energy industry lobby is between Germany's high electricity prices and the low prices in Finland, which are portrayed as benefitting the economy and employment at large.

Positive depictions of German energy policy focus on the indirect economic benefits of the rise of renewable energy (Table 3). The figure of 300,000–400,000 new jobs in the renewables sector is often cited by environmental NGOs, Green Party members and academics. The correlation between investment in renewable energy or green industries and high economic output in countries such as Germany and Denmark is also noted. The benefits of small-scale electricity production are discussed largely in economic terms, with German support for small producers contrasted with Finland's lack of a similar policy, as in the following news article containing an interview: '[Professor Peter] Lund would want Finland to adopt a similar feed-in-tariff as in Germany, where also small producers receive a guaranteed price for renewable energy production'[39].

A small number of articles (5–8%) discuss other positive features of the Energiewende than economic ones. These articles highlight the democratic consensus behind the Energiewende, a German culture of frugal electricity usage, or the lack of debate over non-nuclear energy issues in Finland as opposed to Germany. These articles describe the Energiewende as a social, ethical and political project that entails reimagining the role of energy in society. In a longer piece on energy policy, a journalist writes: 'How does all of this relate to renewable energy? Well, in the sense that energy is also about power and democracy. The one producing energy has power'[40]. This is in line with emphasizing the origin of the Energiewende as a community-led project that was not only about securing energy production.

A distant view focused on individual figures in Hungary

Because the coverage of the Energiewende in *Index* and *Origo* was very similar in terms of both quantity and quality, they were combined in the analysis. There are 56 articles across the two Hungarian sources, out of which 2-10 can be considered in-depth analyses. The tone is 14% positive, 27% negative, 13% ambivalent and 46% descriptive. The small number of articles and the fact that almost half of all references to Germany are descriptive suggests that the Hungarian media are distant observers of the German transition.

Hungarian and German energy policy are rarely compared, and there is no clear vision of domestic goals or strategies in discussions of the Energiewende. The topic of competition almost never appears and very few observers discuss domestic industry from the perspective of international competitiveness. The most frequently mentioned element of a positive future is cheap electricity, which is often contrasted with the high costs of the Energiewende, as in the title 'Environmental consciousness is expensive' (*Index*[41]). Likewise, cost is most

often brought up when renewable energy and nuclear are juxtaposed, as frequently happens in Hungary (Table 3). There are 16 articles whose main topic is domestic nuclear expansion, with titles like 'Government justifies nuclear expansion with clean and cheap electricity' (*Origo*[42]) and 'New reactors in Paks would increase electricity bills' (*Origo*[43]). The contrast between Germany's nuclear phase-out and Hungary's strategy of nuclear new build is the single most important connection made between Hungarian energy policy and the Energiewende. As the titles indicate, references to Germany's alternative direction are used to both question and support current energy policies in Hungary.

In discussions of intermittent renewables, Hungarian media tend to use individual figures from Germany very selectively without providing a broader context. For example, an article in the European policy section of *Index* states that 'in Germany, which has fewer sunny hours on average than Hungary, 40% of national energy needs were provided by solar on July 7, 2013' (*Index*[44]). This creates the impression that solar is already a main source of energy in other countries and could be one in Hungary. But it is not stated that such figures characterize only a few hours on outlier days and refer to electricity rather than total energy demand. In a similar fashion, the most quoted advocate of nuclear power says that 'there are renewable sources in Germany today that receive support of 150 Ft/kWh' and connects this to domestic power prices of 36 Ft/kWh (*Index*[45]). This presents renewables as unaffordable in Hungary in a discussion of new investments. It is not stated that this feed-in-tariff, an outlier, is an historical legacy far above current support and that costs of renewables are falling rapidly towards and below the cost range of traditional sources. In the media of a country that observes the Energiewende from a distance, ambiguous interpretations serving specific interests are not uncommon.

Discussion

Between 2011 and 2015, the German energy transition was frequently discussed in the news media of the United Kingdom, Finland and Hungary (for further qualifications, see Supplementary Note 2 and Supplementary Table 3). Over time, many actors involved in energy policy developed a normative stance. It is remarkable that one country's energy choices have become part of the broader energy policy landscape. This justifies directing analytical attention to how the landscape of sustainability transitions is socially constructed in specific contexts, in order to stabilize or destabilize existing regimes. As the transition process is long, complex and poses new challenges as it proceeds, the German example will likely continue to influence national energy discussions for decades.

In all studied sources, there is a dominant portrayal of the Energiewende as techno-economic, supply-oriented and focused on nuclear, wind and solar energy. There are few discussions of energy democracy and local value creation, energy savings or how higher electricity prices incentivize them and the role of bioenergy in the German transition. This reflects a prevalent tendency to discuss environmental concerns in technological and economic terms[46], focusing on economic structures where electricity production provides better business opportunities than savings, and devoting attention to the highly visible and rapidly growing wind and solar installations. Issues related to the Energiewende not widely discussed today include independence from large

energy companies, local profits, stronger communities and participation, limiting expenditures on electricity through lower consumption and using a portfolio of low-carbon renewables. Bringing these to the conversation can help to combine rhetorical power with a cautious interpretation of the German experience, which is essential to create legitimacy for innovations and to speed up energy transitions.

Each country and interest group creates its own version of the Energiewende by picking specific aspects and linking them to particular domestic visions of a good society. *The Guardian* writes positively about support for renewable energy and changing patterns of ownership that increase its popularity, while *The Times* details how utility companies suffer and almost never mentions energy efficiency or the opportunities presented by a transition. The Finnish discussions centre on costs, jobs and the climate, as well as securing stable electricity supply to meet the needs of an industrial nation. The rather descriptive Hungarian representation concentrates on affordability by juxtaposing nuclear energy with renewables. These domestic concerns will likely persist as technological advances, cost changes, policy measures and popular support transform discussions on the Energiewende. As energy transitions become increasingly likely, debates on successful decarbonisation of national energy systems will require awareness of the changing relationship between domestic visions of a good society and specific lessons to be learned from the German energy transition.

Methods

Data sources

The study is based on articles from news providers in each country that target broad, non-specialist audiences in a mainly national context. By using news articles for the analysis and not studying other media sources or national policy documents, we do not claim to comprehensively present public debates. Rather, our focus on traditional print and online media portrays how global energy policy phenomena, such as the Energiewende, are problematized in particular national contexts. The studied time period, 2011–2015, covers the initial five years of Germany's apparently irreversible nuclear phase-out – an important period where meanings of the transition process are created in the selected countries. We limit the analysis to the first five years as the Hungarian media landscape changed dramatically in 2016.

For the UK, *The Guardian* and *The Times* were used as data sources, accessed through the LexisNexis Academic search engine. These are two non-tabloid newspapers, which lean to the left and the right, and had a reach of 10 million and 6.3 million, respectively, in 2015. Their positions on energy policy are influenced by political orientation, with *The Guardian* repeatedly calling for more concerted action on climate change whereas *The Times* has a history favouring established industrial interests[17,18].

For Finland, we selected *Helsingin Sanomat* as the only nationwide newspaper, which reaches 1.8 million people. *Helsingin Sanomat* claims to be politically independent but has previously been characterized as having a pro-nuclear power position[17]. We conducted searches in the national broadcasting company's (Yle) web news

but could not include the news articles as the search engine did not support Boolean operators and did not retrieve all articles fitting our search terms. We also considered regional newspapers (e.g. *Aamulehti* and *Maaseudun Tulevaisuus*) but did not include them due to their regional focus and hence very limited coverage of the German transition.

In Hungary, printed non-tabloid newspapers lost most of their readers by 2015, selling less than 40 thousand copies each[47]. Therefore, the two most popular online news portals were chosen for the analysis: *Index* and *Origo*. Both have searchable archives and around 1 million users on working days. Both portals claimed to be independent, and in fact did not demonstrate a particular political orientation during the studied period. Both sources represented diverging views on energy policy, paying most attention to nuclear energy issues. In 2016, *Origo* was sold, which shifted the Hungarian media landscape. Since then, *Origo* has favoured government views and *Index* has increasingly challenged these. However, because their coverage of the Energiewende was very similar in terms of both quantity and quality for the study period covered, they were combined in the analysis.

Data collection

We used the news sources' online databases for *Helsingin Sanomat*, *Index* and *Origo* and the LexisNexis database for searches in *The Guardian* and *The Times*. In each database, we carried out five searches in the respective languages with the following combinations of search words (the logical operator AND is denoted by &): 1) energy policy & Germany 2) energy & renewable & Germany 3) energy & decentralized & Germany 4) energy efficiency & Germany 5) Energiewende. In Finnish: 1) energiapolitiikka* & Saksa 2) energia & uusiutuva* & Saksa 3) energia & hajautettu* & Saksa 4) energiatehokkuus & Saksa 5) Energiewende. In Hungarian: 1) energiapolitika & Németország 2) energia & megújuló & Németország 3) energia & dencentralizált & Németország 4) energiahatékonyság & Németország 5) Energiewende. While it is impossible to choose expressions whose usage is perfectly identical in the three languages (partly because of differences in grammar structure), the chosen combinations were considered to capture central elements of the Energiewende and limit the data set to a manageable size (which still meant well over 1000 documents in the original data set for the UK sources). We did not use 'nuclear' as a search word as this would have expanded the data set significantly and would have shifted the focus towards individual nuclear projects in the respective countries and the role of German companies in these.

In our initial data set, all articles were included that appeared in the studied sources and satisfied the conditions of our search. Our aim was to consider the positions of various actors including journalists, policy actors and citizens – everything that could reach readers through the studied outlets. With this, we show the various ways through which particular international phenomena are brought into national contexts through the media. We are not making statements about the actors or the news as such, rather the process of contextualization and how this issue at the landscape level is socially constructed.

Analysis

To begin the analysis, we selected those articles that referred explicitly to German energy policy and the Energiewende. From the selected articles all sentences referring to Germany, as well as contextualizing sentences before and after, were extracted to an Excel spreadsheet. In the Excel spreadsheets, we registered the title; date; type of article (see Table 1); main country discussed; portrayal of Germany as positive, negative, ambivalent or descriptive; speaker names (all speakers quoted); and if the article was mainly on the Energiewende. Articles devoting more than 200 and more than 400 words to the Energiewende were counted, which gave the higher and lower bounds when reporting the number of in-depth discussions (i.e. '1-7 in-depth articles' means that one was above 400 words and seven were above 200 words).

We proceeded with conducting an inductive and iterative coding of texts, without having an upper limit on how many different codes could be assigned to a piece of text. The highest number of codes assigned to a long and detailed article was 15. The UK and Hungarian materials were analysed by the first author and the Finnish material by the second author, whereas the development of codes and the comparison between the different countries was a joint effort. The codes (see Table 2) were developed inductively through several rounds of reading and discussing the material between the two authors. The UK material was used to examine intercoder reliability. Both authors coded 10% of the UK material, then discussed and revised the codes to make sure they were applied consistently. This process was carried out twice using the UK material, as English was the only shared language. To address this limitation arising from the language barrier, we translated several Finnish and Hungarian examples to English and discussed codes that were rare (and therefore difficult to discuss using our UK sample) and codes that appeared more frequently in the Finnish or the Hungarian materials than in the UK sample. A formal intercoder reliability test (Krippendorff's alpha) was conducted for the second round of our comparisons. The tests resulted in high alpha scores (0.8-1) for 15 codes and relatively high alpha scores (0.72-0.8) for 3 codes (see Table 2). These codes either appeared sufficiently frequently in the sample to produce a meaningful comparison or appeared infrequently but coding by the two authors was exactly the same (producing an alpha value of 1). There was one code which appeared only once according to one author and not at all according to the other author (producing an alpha value of 0). 10 codes did not appear in the sample. All infrequent codes were discussed individually throughout the coding process, using several examples from the whole material. Codes that appeared more frequently in the Finnish or the Hungarian materials than the UK sample were translated to English, allowing the authors to discuss all or most of these examples one by one.

The codes were used as an entry point to query the material: What type of an example is the Energiewende made to be? What parts of it are highlighted and what are not? How is German energy policy discussed with reference to domestic choices? We first examined the most popular codes and then proceeded to question why other codes were less popular or altogether lacking. In our discussion of the results, to go beyond codes, we selected specific quotations to represent characteristic viewpoints of different sources in this article.

In addition to the codes, we categorized the articles based on their normative description of German energy policy as positive, negative, ambivalent or descriptive. While such a categorization is bound to have ambiguities and overlap, we found it useful to give a broad overview of how German energy policy is portrayed across the different contexts and time. When reporting percentage breakdowns, totals do not always add up to exactly 100% due to rounding.

Throughout the discussion of our results, we use the mentioned quantitative indicators to characterize the material. This facilitated the analysis between three different countries and two authors through finding common themes and divergent topics. In our figures we present these indicators to offer rough descriptions of the material. However, we want to stress that our analysis was an iterative process, where quantitative descriptions were mainly used to facilitate qualitative analysis and interpretation of the empirical material. For instance, we do not claim that the selected codes and their quantitative presentation in the article (Table 3) comprehensively capture all elements of locally specific discussions on the Energiewende. The broad qualitative trends, rather than the numerical results can be considered as outcomes of this research.

Data availability statement

All articles analysed in this study are available through the news provider databases. Access to the databases of *The Guardian*, *The Times* and *Helsingin Sanomat* are subject to subscription. Data are available from the authors upon reasonable request.

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Competing interests

The authors declare no competing interests.

Author contributions

MA and KK designed and conducted the study together. MA analysed the material for the UK and Hungary, KK analysed the material for Finland. MA and KK wrote the paper together.

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